

01-31-05

EW
BEST AVAILABLE COPY



PATENT

Attorney Docket No: 779-X03-002

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor: John DAVIES

Serial No.: 10/626,187

Filed: July 24, 2003

Title: MICROPHONE ADAPTOR FOR A RESPIRATOR

CERTIFICATE OF EXPRESS MAILING

PATENTS

EXPRESS "Express Mail" Mailing Label number EV333612278 US

Date of January 28, 2005

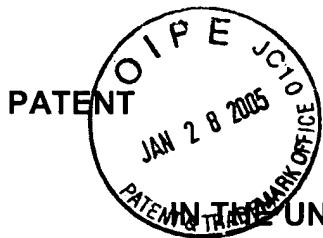
I hereby certify that the attached paper(s) or fee(s) is/are being deposited with the United States Postal Services "Express Mail Post Office to Addressee" service under 37 CFR §1.10 on the date indicated above and is addressed to the Commissioner for Patents, P.O.Box 1450, Alexandria, VA 22313-1450.

Estefania Belaunde

(Signature of person mailing paper or fee)

ESTEFANIA BELAUNDE

(Typed or printed name of person mailing paper or fee)



Attorney Docket No: 779-X03-002

UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: John DAVIES

Serial No.: 10/626,187

Group Art Unit: 3743

Filed: July 24, 2003

Examiner: Mitchell, Teena Kay

Confirmation No. 1556

Title: MICROPHONE ADAPTOR FOR A RESPIRATOR

SUBMISSION OF PRIORITY DOCUMENT

COMMISSIONER FOR PATENTS

P.O. Box 1450

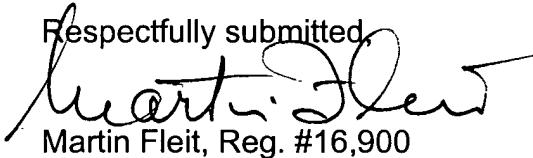
Alexandria, VA 22313-1450

SIR:

Enclosed is a certified copy of the corresponding British patent application for which priority is claimed under 35 USC 119.

<u>Country</u>	<u>Application No.</u>	<u>Filing Date:</u>
GREAT BRITAIN	0102232.6	January 29, 2001

No fee is believed to be due with this submission. However, if any fees are due, please charge any required fee (or credit any overpayments of fees) to the Deposit Account of the undersigned, Account No. 500601 (Docket no 779-X03-002)

Respectfully submitted,

Martin Fleit, Reg. #16,900

Enclosures

Martin Fleit
FLEIT KAIN GIBBONS GUTMAN BONGINI & BIANCO
601 Brickell Key Drive Suite 404
Miami, Florida 33131
Tel: 305-416-4490; Fax: 305-416-4489
e-mail: MFleit@Focusonip.com

BEST AVAILABLE COPY



• PATENTS • DESIGNS
The
Patent
Office
• COPYRIGHT • TRADE MARKS

055117/626, 187
HKT/01/7 37643



**CERTIFIED COPY OF
PRIORITY DOCUMENT**

The Patent Office
Concept House
Cardiff Road
Newport
South Wales
NP10 8QQ

the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

also certify that the attached copy of the request for grant of a Patent (Form 1/77) bears an amendment, effected by this office, following a request by the applicant and agreed to by the Comptroller-General.

accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name in which it is so re-registered.

accordance with the rules, the words "public limited company" may be replaced by p.l.c., P.L.C. or PLC.

Registration under the Companies Act does not constitute a new legal entity but merely subjects the company to certain additional company law rules.

Signed

Dated 21 December 2004

Andrew George



Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

The Patent Office
Cardiff Road
Newport
Gwent NP9 1RH

"Address for service" in the United Kingdom
to which all correspondence should be sent
(including the postcode)

MARCONI INTELLECTUAL PROPERTY
WATERHOUSE LANE ~~Foges Toffee~~
CHELMSFORD Toffee Patent and Trade Mar
ESSEX CM1 2QX Toffee Dragee
23001 Monca Combs
7794196001 PEIS 03X
7794196001

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number	Country / Priority application number (if you know it)	Date of filing (day / month / year)
7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application	Number of earlier application	Date of filing (day / month / year)
8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'Yes' if: a) any applicant named in part 3 is not an inventor, or b) there is an inventor who is not named as an applicant, or c) any named applicant is a corporate body See note (d))	YES	

9. Enter the number of sheets for any of the following items you are filing with this form.
Do not count copies of the same document

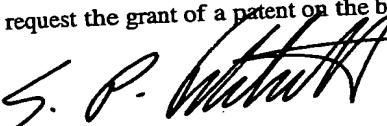
Continuation sheets of this form

Description	0
Claim(s)	11
Abstract	4
Drawing(s)	1
	2 + 2 ren

10. If you are also filing any of the following, state how many against each item.

Priority documents	0
Translations of priority documents	0
Statement of inventorship and right to grant of a patent (Patents Form 7/77)	1
Request for preliminary examination and search (Patents Form 9/77)	1
Request for substantive examination (Patents Form 10/77)	
Any other documents (please specify)	

11. I/We request the grant of a patent on the basis of this application.



Signature

Date

STUART FITCHETT

29 January 2001

12. Name and daytime telephone number of person to contact in the United Kingdom

Warning
After an application for a patent has been filed, the Comptroller of the Patent Office will consider whether publication or communication of the invention should be prohibited or restricted under Section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you live in the United Kingdom, Section 23 of the Patents Act 1977 stops you from applying for a patent abroad without first getting written permission from the Patent Office unless an application has been filed at least 6 weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked.

Notes

- a) If you need help to fill in this form or you have any questions, please contact the Patent Office on 0645 500505.
- b) Write your answers in capital letters using black ink or you may type them.
- c) If there is not enough space for all the relevant details on any part of this form, please continue on a separate sheet of paper and write "see continuation sheet" in the relevant part(s). Any continuation sheet should be attached to this form.
- d) If you have answered 'Yes' Patents Form 7/77 will need to be filed.
- e) Once you have filled in the form you must remember to sign and date it.
- f) For details of the fee and ways to pay please contact the Patent Office.

Patent et 1977
(Rule 15)



The
Patent
Office

**Statement of inventorship and of
right to grant of a patent**

The Patent Office
Cardiff Road
Newport
Gwent NP9 1RH

1. Your reference

P/63218.DIC

2. Patent application number
(if you know it)

0102232.6

29 JAN 2001

3. Full name of the or of each applicant

Davies Industrial Communications Ltd

4. Title of the invention

A MICROPHONE ADAPTOR FOR A RESPIRATOR

5. State how the applicant(s) derived the right
from the inventor(s) to be granted a patent

BY VIRTUE OF SECTION 39(1) OF THE PATENTS ACT 1977

6. How many, if any, additional Patents Forms
7/77 are attached to this form?
(see note (c))

0

7.

I/We believe that the person(s) named over the page (and on
any extra copies of this form) is/are the inventor(s) of the
invention which the above patent application relates to.

Signature

Date

STUART FITCHETT

29 January 2001

8. Name and daytime telephone number of
person to contact in the United Kingdom

STUART FITCHETT
01245 275450

Notes

- a) If you need help to fill in this form or you have any questions, please contact the Patent Office on 0645 500505.
- b) Write your answers in capital letters using black ink or you may type them.
- c) If there is more than three inventors, please write the names and addresses of the other inventors on the back of another Patents Form 7/77
- d) When an application does not declare any priority, or declares priority from an earlier UK application, you must provide enough copies of this form so that the Patent Office can send one to each inventor who is not an applicant.
- e) Once you have filled in the form you must remember to sign and date it.

DAVIES John
"Strathmore"
Sutton Road
Wigginton
York YO32 2RB

Enter the full names, addresses and postcodes of the inventors in the boxes and underline the surnames

Patents ADP number (if you know it) 1026681002

Patents ADP number (if you know it)

Patents ADP number (if you know it)

Reminder

Have you signed the form?
Patents Form 7/77

A MICROPHONE ADAPTOR FOR A RESPIRATOR

The present invention relates to a microphone adaptor for a respirator and particularly, but not exclusively, to such an adaptor for use with a nuclear, biological and chemical (NBC) respirator of the type worn by service personnel

5 Defence organisations throughout the World have for many years supplied soldiers and other service personnel with respirators to protect them from NBC exposure. Respirators are normally in the form of a full face mask protecting the complete face of the service personnel wearing them including the eyes. The respirator seals tightly against the face to ensure that air breathed is drawn in through an appropriate filter and exhaled through a one
10 way non-return valve (exhale valve).

Respirators are normal made out of a rubber type material so that they are flexible enough to permit a standard issue respirator to fit and seal against the many varied face shapes that may find themselves wearing such a respirator. Unfortunately the materials respirators are
15 normally manufactured from are not particularly efficient at transmitting acoustic sound waves and thus there is a problem permitting service personnel to communicate, either with each other directly or via radio, when they are wearing NBC respirators.

Originally the problem with radio communications was addressed by having a microphone
20 mounted to the front of a respirator through which an operative could communicate with a radio. However this did not solve the problem of enabling the operative to communicate with his immediate colleagues by direct speech. To solve this problem some respirators

now incorporate a speech projector mounted in front of the respirator in front of the operatives mouth. One such respirator is the S10 used by the British Army, seen in figures 1 and 2 on the accompanying drawings (figure 2 being a cross section along the line 1-1 of figure 1). The speech projector enables the operative to talk, or shout, directly to his 5 colleagues, but this has necessitated relocation of the microphone for his radio and a speech diaphragm has been incorporated at the side of the mask to which a standard issue microphone may be fitted, either by clipping or screwing over the speech diaphragm. The speech diaphragm is adapted to be "sound transparent" relative to the other material of the respirator whilst ensuring a complete seal to ensure protection of the operative whether or 10 not the microphone is fitted, or fitted incorrectly.

Respirators typically comprise an inner face seal, which is between the mouth of the operative and the speech diaphragm. This inner face seal degrades speech reaching the speech diaphragm and indeed the speech diaphragm itself is not perfectly transparent to 15 speech. Thus speech received by a microphone mounted to the speech diaphragm is of relatively poor quality compared to speech that would be received directly from the operative.

In addition to the above problem, of transmission of speech through the inner seal and the 20 speech diaphragm, the performance of a respirator microphone in high background noise is also poor because the coupling to the microphone has to be open to the air otherwise a pressure wave between the microphone and the respirator further distorts speech.

The present inventor has realised that although the present arrangement is used by many of the world's military forces the above problems will be particularly problematic when the next generation of digitally encrypted radios are employed for the following reason.

- 5 The future use of military radios will involve the addition of digitally encrypted speech to increase the security of radio messages. Digitally encryption involves the conversion of analogue speech to a digital signal before encryption in the transmitting radio. The characteristics of digital conversion often result in the lower frequencies of the audio band having a disproportionate influence on the encryption due to the greater values placed by
- 10 the system on lower frequencies.

Research by the inventor on radios of this type has shown that normal speech emanating from conventional respirator microphones deteriorates to a greater extent when transmitted over an encrypted radio link than when used over a clear radio link. The use of

- 15 microphones with better response at higher frequencies improves the performance, so it can be deduced from this observation that the resonant effect of the respirator and the increased low frequency response of a conventional microphone working through a speech diaphragm of a respirator is a contributing factor to the degradation.

- 20 The present invention aims to provide a solution to the above problem identified by the present inventor.

According to a first aspect of the present invention there is provided a microphone adaptor for a respirator having a speech projector, the adaptor comprising a sound tube with a first

open end arranged to be located in the vicinity of the speech projector of the respirator and a second open end arranged to be attached to a microphone, whereby speech emanating from the speech projector can be transmitted via the sound tube of the adaptor to the microphone.

5

The present invention enables speech to be received from the speech projector of a modern respirator without the need to mount a microphone in the proximity of the speech projector, which may impede the speech from the speech projector. More importantly, by employing the present invention speech is received from the speech projector which speech

10 has a direct path from the mouth of the operator through the open exhale diaphragm (one has to exhale to speak) through the sound projector to the microphone via the microphone adaptor. The advantage of this is that because the speech is direct, and has not passed through the fabric of the respirator, the high frequency components are substantially intact making the invention particularly advantageous if the microphone is connected to a 15 digitally encrypted radio.

Preferably the adaptor comprises a microphone box in which the second open end of the sound tube terminates, said box being arranged to fit over a microphone and shield the microphone from any incident sound other than that received via the sound tube. This 20 enables the adaptor to be fitted over an already existing microphone which may be associated with the operative and preferably the microphone box is arranged to reasonably push over a microphone enabling the adaptor to be easily fitted over the microphone only when the respirator is being worn. Thus the microphone box can be removed and the microphone used normally when the respirator is not being worn.

The present invention provides significant advantages over current arrangements, where a standard issue microphone is clipped to the speech diaphragm on the side of the respirator. In addition to the improvement in speech quality there is also no requirement for an additional respirator microphone. This is particularly advantageous for this would require an additional connector for that microphone. This, for example, may avoid the need to employ an additional connector on the operatives headset, comprising earphones and a boom microphone, which connector, if to military standard, would be bulky and a potential hazard relative to the typically otherwise lightweight and "soft" components of the headset.

10 Also a specially wired and switched headset will not be required, which would otherwise be necessary to allow muting of the standard microphone when the external respirator microphone is connected.

It is particularly advantageous if the microphone box is arranged to push over a boom microphone of a headset, for in the event of an NBC incident the operative can simply put the respirator on, put his headset back on and slip the boom microphone into the microphone box of the adaptor.

20 In addition to the "convenience" and improved performance provided by the present invention there is also a significant cost saving. The costs of an adaptor in accordance with the present invention are of the order of one tenth of costs associated with the current microphone arrangement.

The adaptor of the invention may comprise a sound tube locator attached to the first open end of the sound tube and arranged to locate the sound tube in the speech projector of a respirator. The adaptor may be arranged to be a push fit and may either releasably attach to the speech projector or permanently attach the adaptor in position.

5

As the adaptor of the present invention can be lightweight, robust and relatively cheap, and because it does not interfere to any significant extent with the speech projected by the speech-projector, it may be advantageous to leave the adaptor permanently in position on the speech projector to ensure that it is not misplaced.

10

In accordance with a second aspect of the invention there is provided a respirator having a speech projector and a microphone adaptor as described above. In accordance with this aspect of the invention the sound tube may be formed as part of the respirator and the tube may be integrally moulded within the material of the respirator.

15

The respirator preferably comprises an exhale diaphragm located in a region substantially in front of the mouth of an operative which diaphragm opens into the speech projector to provide a direct passage between the mouth of the operative and the first open end of the sound tube when the operative exhales during the speech process. This provides a clear passage for speech direct to the microphone.

20

In accordance with a third aspect of the invention there is provided Battlefield communication equipment comprising:

a headset to be worn by an operative, the headset having earphones, a boom microphone and a connection for a radio enabling the operative to have two way communication;

a respirator; and

5 a microphone adaptor, the microphone adaptor having a sound tube and a microphone box arranged such that when the operative is wearing the respirator the operative can put the sound box over the boom microphone of the headset, the adaptor being arranged to receive speech from within the respirator and transmit that speech via the sound tube and microphone box to the boom microphone

10

One embodiment of the present invention will now be described by way of example only with reference to the accompanying figures of which:

15 Figure 1 illustrates a respirator and microphone adaptor in accordance with the present invention;

Figure 2 is a cross section through the line 1 - 1 of figure 1;

20 Figure 3 is a perspective view of the components of the microphone adaptor of figures 1 and 2;

Figure 4A illustrates the microphone box of the microphone adaptor of figure 3 prior to connection to a boom microphone;

Figure 4b illustrates the microphone box of figure 4 attached to the boom microphone; and

Figure 5 schematically illustrates the connections of a boom microphone to a headset and
radio.

5

Referring now to figures 1 and 2, a respirator, indicated generally as 1, comprises a rubber mask body 2 having two windows 3 and 4, a speech projector 5, an inlet filter 6, a speech diaphragm 7, a drinking tube 8 and, (shown in figure 2 only) an inner face seal 9 for sealing to the face of an operative (indicated by the broken line) the face seal 9 having an inlet diaphragm 10 and an exhale diaphragm 11 therein.

The components so far referred to are standard on some respirators and the respirator illustrated is an S10 used by the British Army. In figure 1 two additional components have been shown for illustrative purposes only and that is the filter canister 12, attached to the filter canister fitting 6, (through which air is drawn in) and a standard issue service microphone 13, which clips to the speech diaphragm 7, but is shown for illustrative purposes only as this is redundant when the present invention is employed.

Also shown fitted to the respirator of figures 1 and 2 is a microphone adaptor in accordance with the present invention indicated generally as 14. This comprises a sound tube locator 14a, sound tube 14b and microphone box 14c clipped over a boom microphone 15 of a headset.

As shown more clearly in figure 3 the adaptor comprises sound tube locator 14a which may be made of rubber or similar elastic material attached to a first open end of a sound tube 14b, which may be formed of polyurethane or some other material which is preferably semi rigid such that it retains the shape illustrated. To the second open end of the sound tube 14b is attached to microphone box 14c.

Referring to figure 4A, a microphone box 14c is shown remote from headset boom microphone 15, and in figure 4B shown mounted over the boom microphone. From figures 4A and 4B it is seen that the microphone box 14c comprises a sound tube 16, which 10 extends the sound tube 14b to the microphone transducer 17.

Referring to figure 5, for completeness, there is shown a boom microphone 15, attached to standard headset 18, which in turn is attached by lead 19 to a digitally encrypted radio 20.

15 In operation the respirator functions by air being filtered by the canister 12 of figure 1 as it is drawn through inlet diaphragm 10 in inner face seal 9 by the action of an operative breathing in. The purpose of the inner face seal 9 is to ensure that only fresh air coming into the mask can reach windows 3 and 4 by confining exhaled air within the region below windows 3 and 4 defined by the inner face seal 9. Air that is breathed out by an operative 20 passes through exhale diaphragm 11 through speech projector 5 to atmosphere without coming into contact with the windows, thus reducing any problems with condensation.

The speech projector 5 comprises a plastic nose cone with curves shaped inside the nose cone resembling a loudspeaker re-entrant horn. Speech projector 5 enables an operative to

speak directly to his colleagues for in the process of speaking he will exhale opening exhale diaphragm 11, thus providing a direct speech path to the outside via speech projector 5.

5 The sound tube locator 14 is simply pushed in to the plastic nose cone of the speech projector 5 where it is retained in place by means of lip 14d engaging behind the nose cone, as shown in figure 2. The sound tube locator 14a has a cross section which, as seen in figure 1, orientates it such that the microphone box is positioned along the outside of the respirator, in the approximate location of a boom microphone attached to the headset 18 of
10 an operative.

The microphone adaptor 14, when attached to the microphone 15, forms a path which when an operative speaks and exhales, thereby opening exhale diaphragm 11, provides a direct and unimpeded sound path from the mouth of the operative through the exhale diaphragm 11 and speech projector 5 to the microphone 15, via the sound tube 14b and microphone box 14c. This direct path enables speech to be received by the microphone with relatively little degradation of the high frequency components.

15 The adaptor 14 may be configured such that it is permanently retained in the speech projector or it may be configured such that it may be removable. Whichever, when an NBC incident occurs the operative removes his headset, puts the respirator over his head in the normal manner and then, replacing his headset, pushes the microphone box 14c, of the adaptor 14, over the headset boom microphone 15. The operative is then able to communicate efficiently via his digitally encrypted radio 20, shown in figure 5, by means

of the normal headset 18 without any additional microphone, wires or connections associated therewith having to be employed.

The above describes a preferred embodiment and is given by way of example only. It will readily be appreciated that the invention, as defined by the scope of the appended claims, may be employed in any number of configurations. Particularly the microphone adaptor illustrated has been designed for use with existing standard issue respirators. However it is realised that if a new respirator is to be designed it would be possible to build a microphone adaptor into the respirator and in such a scenario the sound tube could comprise a passage within the material of the respirator itself. This passage would extend between the speech projector and the microphone box which could likewise comprise a recess in the material of the respirator in which recess the sound tube would terminate and which recess is adapted for receiving the headset boom microphone. Additionally, in the embodiment illustrated advantage has been taken of the speech projector already incorporated in many existing respirators. However the sound tube, whether an "add-on" or integrally formed within the respirator, could extend directly to the point at which there is a direct clear path to the operatives mouth. However it would be preferable that the sound tube extend only to the down stream side of the exhale diaphragm such that the sound tube could not compromise the integrity of the respirator by allowing contaminated air to reach the inside of the inner face seal.

CLAIMS

1. A microphone adapter for a respirator having a speech projector, the adapter comprising a sound tube with a first open end arranged to be located in the vicinity of the speech projector of the respirator and a second open end arranged to be attached to a microphone, wherein speech emanating from the speech projector is transmitted via the sound tube to the microphone.
2. The adapter of claim 1 comprising a microphone box in which the second open end of the sound tube terminates, said box being arranged to fit over a microphone and shield the microphone from any incident sound other than that received via the sound tube.
3. The adaptor of claim 1 or 2 comprising a microphone box arranged to releasably push over a microphone.
4. The adaptor of claim 2 or 3 wherein the microphone box is made of an elastic material.
5. The adaptor of claim 2, 3 or 4 wherein the microphone box is arranged to push over a boom microphone of a headset.

6. The adaptor of any preceding claim comprising a sound tube locator attached to the first open end of the sound tube and arranged to locate the sound tube in the speech projector of the respirator.
7. The adaptor of claim 6 wherein the locator is arranged to be a push fit.
8. The adaptor of claim 6 or 7 wherein the locator is arranged to releasably attach to the speech projector.
9. The adaptor of claim 6 or 7 wherein the locator is arranged to retain the locator permanently in position in the speech projector.
10. The adaptor of any preceding claim wherein the sound tube comprises a piece of tubing.
11. A respirator having a speech projector and a microphone adaptor as claimed in any one of claims 1 to 5.
12. The respirator of claim 11 wherein the sound tube is formed as part of the respirator.
13. The respirator of claim 12 wherein the sound tube is integrally moulded in the material of the respirator.

14. The respirator of any one of claims 11 to 13 wherein the respirator is a nuclear, biological or chemical respirator (NBC).
15. The respirator of any one of claims 11 to 14 comprising an exhale diaphragm located in a region substantially in front of the mouth of a wearer of the respirator, which diaphragm opens into the sound projector to leave a clear passage between the mouth of the wearer and the first open end of the sound tube when the wearer exhales during the speech process.
16. The respirator of any one of claims 11 to 15 further comprising an inner face seal internal of an outer layer of the respirator wherein the exhale diaphragm extends through both the internal face seal and the outer layer.
17. Battlefield communication equipment comprising:
 - a headset to be worn by an operative, the headset having earphones, a boom microphone and a connection for a radio enabling the operative to have two way communication;
 - a respirator; and
 - a microphone adaptor, the microphone adaptor having a sound tube and a microphone box arranged such that when the operative is wearing the respirator the operative can put the sound box over the boom microphone of the headset, the

adaptor being arranged to receive speech from within the respirator and transmit that speech via the microphone tube and microphone box to the boom microphone.

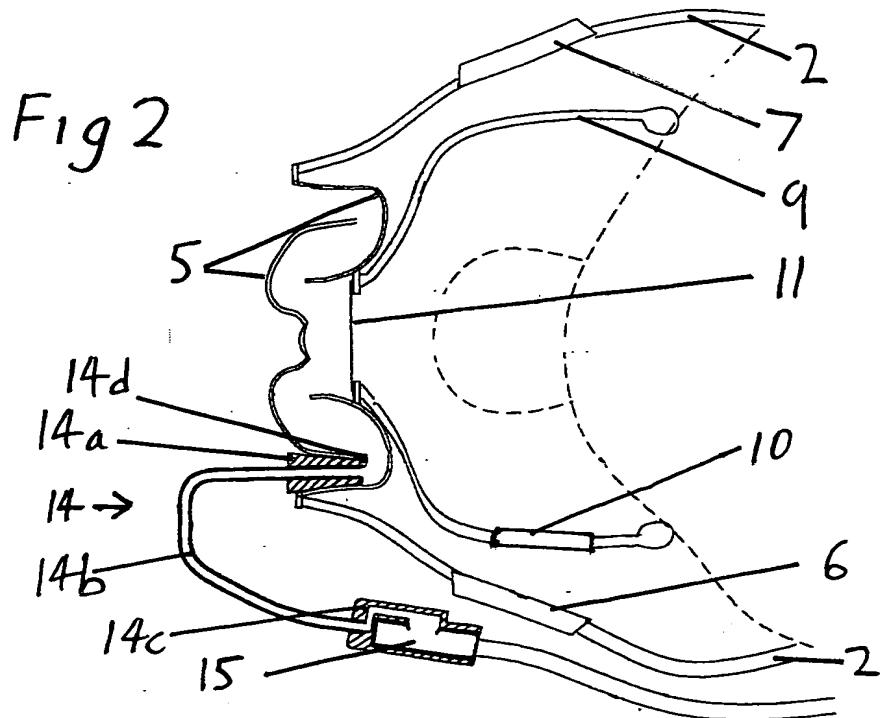
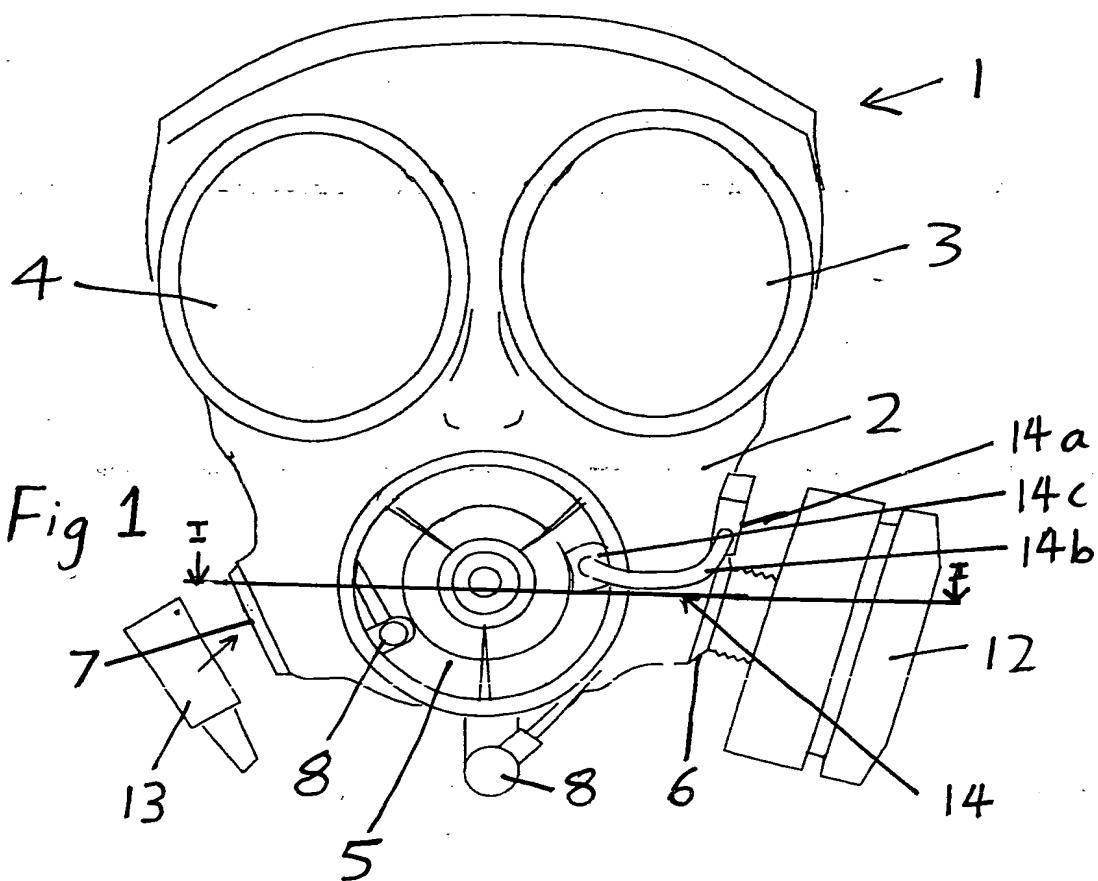
18. The equipment of claim 17 wherein the respirator comprises a speech projector and the adaptor is arranged to receive speech from within the respirator via said speech projector.
19. The equipment of claim 18 comprising the adaptor of any one of claims 1 to 10.
20. The equipment of claim 18 or 19 comprising the respirator of any one of claims 11 to 16.
21. The equipment of any one of claims 17 to 20 further comprising a digitally encrypted ratio to which the microphone is connected
22. A microphone adaptor for a respirator substantially as hereinbefore described with reference to, and/or as illustrated in, the accompanying figures.

ABSTRACTMICROPHONE ADAPTOR FOR A RESPIRATOR

A microphone adaptor (14) for a respirator (1) is provided which comprises a sound tube (14B) and extends between a speech projector (5) of the respirator and a microphone (15) enabling clear speech to be received by the microphone. Advantageously the adaptor comprises a microphone box (14C) for receiving microphone (15) and this is preferably a headset boom microphone of a standard issue headset (18)

Figure 1.

112



212

Fig 3

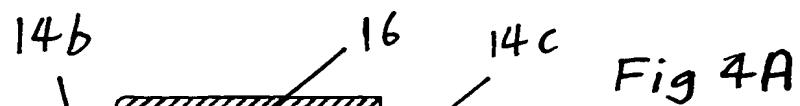
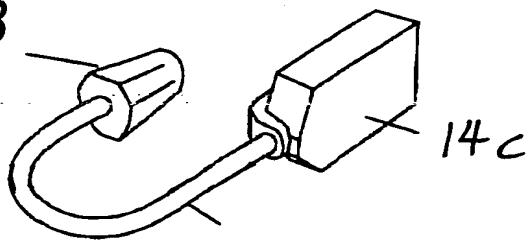


Fig 4A

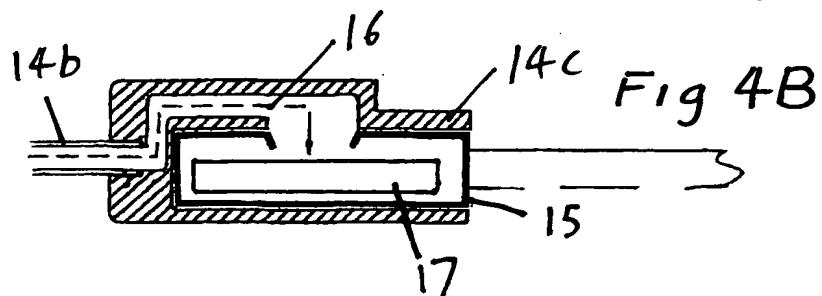
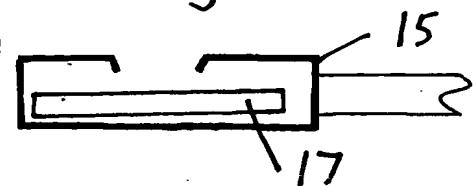
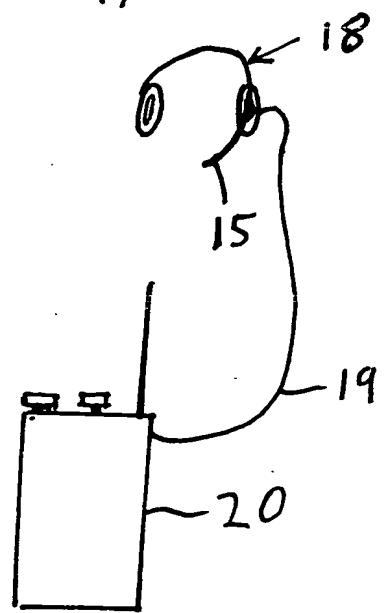


Fig 4B

Fig 5



**This Page is Inserted by IFW Indexing and Scanning
Operations and is not part of the Official Record**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- BLACK BORDERS**
- IMAGE CUT OFF AT TOP, BOTTOM OR SIDES**
- FADED TEXT OR DRAWING**
- BLURRED OR ILLEGIBLE TEXT OR DRAWING**
- SKEWED/SLANTED IMAGES**
- COLOR OR BLACK AND WHITE PHOTOGRAPHS**
- GRAY SCALE DOCUMENTS**
- LINES OR MARKS ON ORIGINAL DOCUMENT**
- REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY**
- OTHER:** _____

IMAGES ARE BEST AVAILABLE COPY.

As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.